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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the image-processing approach, the equipment, and the record medium which perform the image processing according to the histogram of image data.

[0002]

[Description of the Prior Art] It has become possible to treat the digital image which consists of gradation of many of pixels many in recent years by large capacity-ization of record media, such as CPU of a computer, improvement in the speed of a bus, memory, and a hard disk, a magneto-optic disk.

[0003] In connection with this, a digital camera, a film scanner, etc. as an input means of a digital image spread, and using the digital image picturized with the digital camera and the digital image which digitized the conventional film photo by the film scanner for the same purpose as the conventional film photo to appreciate has been increasing.

[0004] For the following reasons, the digital input image of the photograph tone as a thing which replaces this conventional film photo has that that exposure is not appropriate.

[0005] For example, if photography by the usual camera is taken for an example, when the exposure is not chosen suitably, the whole image may become bright too much, or the excess of the exposure for which the detail of a photographic subject stops being able to recognize easily by the whole image becoming dark too much, or the condition of an exposure undershirt may be produced.

[0006] Moreover, since a digital camera photos an image using a CCD component, to human being's eyes, wavelength, such as infrared light which is not sensed, may also incorporate it. If exposure amendment by check by looking was performed here, though exposure was chosen exactly, in a light field, it is possible [it] that the condition of overexposure arises incorporating invisibility infrared light. Although processing of an infrared cut-off filter etc. is also made, of course, since it is not necessarily perfect, it is possible that the above situations arise.

[0007] Furthermore, even if the exposure itself is appropriate, it may be visible to poor exposure. Checking an object by looking is known as the cause, human being amending the difference in the brightness of a surrounding environment (adaptation). When human being compares the image in the storage with the photograph taken with the camera even if the camera is reproducing brightness correctly since a camera records the difference in brightness on record media, such as a film or a memory card, as it is, it may look as a result to poor exposure.

[0008] Therefore, it is required to change into the image which amended the poor exposure in a digital image according to the exposure of an image so that recognition of human being might be approached, and had suitable halftone, in order to improve the image quality of a photograph tone digital image.

[0009] the exposure which shows an exposure undershirt and an exaggerated photograph tone image to drawing 10 -- luminance distribution inclines toward the low brightness region or the high brightness region like the brightness histogram of an exaggerated image. Conventionally, overexposure and an exposure undershirt judging are performed using the reference value considered to express the distribution condition about a brightness histogram.

[0010] For example, overexposure and an exposure undershirt judging are performed on JP,09-068764,A specifications using at least one of criteria maximum, the criteria minimum value, and the average values, and the approach of carrying out image amendment is proposed.

[0011]

[Problem(s) to be Solved by the Invention] Using the conventional approach, in case it is going to perform the judgment of overexposure and an exposure undershirt, the portrait image and backlight scene image which were photoed as a difficult image of a suitable judgment using the flash plate of Nighttime are raised.

[0012] For example, although the brightness histogram of a portrait image generally becomes in the night of drawing 13 like the brightness histogram at the time of carrying out person photography using a stroboscope, by the approach in comparison with the criteria maximum indicated by the above-mentioned official report or the threshold value which serves as criteria about the criteria minimum value, a portrait image will be judged in overexposure and an exposure undershirt judging judging to be an exposure undershirt. Moreover, it is similarly judged with overexposure by the backlight scene image in many cases.

[0013] The above-mentioned official report has indicated [this] the technique using the average which will be seasoned with the brightness value about a person field about the portrait image. The image field which asks the person who is the field where brightness is high compares with the area of an image by the image like drawing 13. However, when small, namely, when the peak of the frequency distribution by the side of the high brightness in a histogram shows comparatively low frequency The cumulative frequency is absolutely pulled by the peak of the frequency distribution by the side of large low brightness, and the average is located in a low brightness side, and even if the exposure about the main photographic subject slack person is appropriate, it will be judged to be an exposure undershirt.

[0014] Moreover, in case image amendment is carried out about a backlight scene image, if the look-up table (LUT) used in order to amend the brightness value of an overexposure image is used, the person field located in a low brightness region will become dark too much.

[0015] This invention aims at enabling it to perform a suitable image processing according to an exposure.

[0016] Invention of this application claim 1 aims at enabling it to perform the image processing which judged and carried out backlight scene ** of the image of a backlight scene.

[0017] Invention of this application claim 8 judges the image with which the **** image pick-up of the night was carried out for stroboscopes, and aims at enabling it to perform the image processing which carried out backlight scene **.

[0018]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the image-processing approach of this application claim 1 publication inputs the image data which shows an object image, creates the histogram of said object image, and is characterized by whether based on said created histogram, said object image is a backlight image, and judging and setting up image-processing conditions based on said judgment result.

[0019] Moreover, the image-processing approach of this application claim 8 publication inputs the image data which shows an object image, creates the histogram of said object image, and is characterized by whether said object image is an image with which the **** image pick-up of Nighttime was carried out for stroboscopes, and judging and setting up image-processing conditions based on said judgment result based on said created histogram.

[0020]

[Embodiment of the Invention] [1st operation gestalt] With reference to a drawing, this operation gestalt is hereafter explained to a detail.

[0021] An example of the outline of the system in this operation gestalt is shown in drawing 1.

[0022] A printer 106 and monitors 105, such as an ink jet printer, are connected, and it is in a host computer 100. A host computer 100 has considering the printer driver 103 which processes the various drawing instruction groups (an image drawing instruction, a text drawing instruction, graphics drawing

instruction) which show the output image published by OS102 with the application software 101, such as a word processor, a spreadsheet, and the Internet browser, and OS (Operating System)102 and this application, and creates print data, and the monitor driver 104 which processes the various drawing instruction groups which application publishes, and displays on a monitor 106 as software.

[0023] A host computer 100 is equipped with arithmetic and program control CPU 108, the hard disk driver HD 107, random access memory 109, and read only memory ROM110 grade as various hardware to which these software can operate.

[0024] as the operation gestalt shown by drawing 1 -- for example, AT of IBM which has generally spread -- Windows 95 of Microsoft is used for a compatible personal computer as an OS, the application which can print arbitration is installed, and the gestalt which connected the printer with the monitor is considered as 1 operation gestalt.

[0025] Output image data is created using the image image data classified into the graphics data classified into graphics, such as text data, a graphic form, etc. which are classified into texts, such as an alphabetic character, according to a host computer 100 with application 101 based on the display image displayed on the monitor, natural drawing, etc. And when carrying out the printout of the output image data, a printout demand is given to OS102 from application 101, and, as for a graphics data part, the amount of [a graphics drawing instruction and] image image data division publish the drawing instruction group which shows the output image which consists of image drawing instructions to OS102. OS102 receives the output request of application and publishes a drawing instruction group to the printer driver 103 corresponding to an output printer. A printer driver 103 processes the printing demand and drawing instruction group which were inputted from OS102, creates the print data which can be printed by the printer 105, and transmits them to a printer 105. When a printer 105 is a raster printer, to the drawing instruction from OS102, a printer driver 103 performs image amendment processing one by one, after it rasterizes it to the 24 bit page memory of RGB one by one and it rasterizes all drawing instructions, it holds data format which a printer 105 can print, changes into CMYK data, and transmits the contents of the 24 bit page memory of RGB to a printer.

[0026] The processing performed by the printer driver 103 is explained using drawing 2 .

[0027] The image amendment processing section 120 performs image amendment processing to the color information included in the drawing instruction group inputted from OS102. In this image amendment processing, RGB color information is changed into brightness and a color-difference signal, exposure amendment processing is performed to a luminance signal, and inverse transformation of the amended brightness and the color-difference signal is carried out to RGB color information. Using the color information by which image amendment processing was carried out first, the amendment processing section 121 for printers rasterizes a drawing instruction, and generates a raster image on the 24 bit page memory of RGB. And the CMYK data for which it depended on the color reproduction nature of a printer to each pixel are generated, and it transmits to a printer 105.

[0028] Next, the procedure about the exposure amendment processing performed in the image amendment processing section is explained, referring to the flow chart shown in drawing 3.

[0029] Exposure amendment processing is performed to a part for the image image data division about the same image shown with an image drawing instruction. When it follows, for example, the graphics image and the image image are contained in the output image, the image image part about the same image is extracted, and exposure amendment processing is performed.

[0030] In S32, brightness data are created from the RGB image data which constitute each pixel value about all the pixels in an image, the sequential count of the frequency is carried out based on a brightness value, and a brightness histogram is created.

[0031] In addition, it is also possible to choose suitably the pixel which the need of investigating a brightness value about all the pixels that constitute an image, and creating a brightness histogram in the case of brightness histogram creation does not not necessarily have, and serves as an object which investigates a brightness value.

[0032] In S33, step S33 determines the highlights point (HL) and the shadow point (SD) of an image based on the created brightness histogram.

[0033] Next, the detail of the approach of determining the highlights point and the shadow point is explained concretely.

[0034] For example, in JP,60-57594,A public relations, the approach of searching for as the shadow point is proposed [lower limit / the highlights point and] in the upper limit of the luminance signal corresponding to the predetermined cumulative frequency, for example, 1%, which created the cumulative frequency histogram and was beforehand set up in the cumulative frequency histogram about the luminance signal in which each chrominance signals R, G, and B of an input signal carried out weighting addition, and 99%, respectively.

[0035] With this operation gestalt, for example about the image data of a 350,000-pixel number, 3500 which corresponds to the about 1% is set up as a threshold, and the point that an accumulation brightness frequency value turns into the above-mentioned threshold from each edge of the brightness value 0 and the brightness value 255 in the direction of a core is determined as the shadow point and the highlights point, respectively.

[0036] When you set the frequency of the pixel of brightness Y_n with n , it asks for cumulative frequency with $n_0+n_1+\dots$, and, specifically, let a brightness value (Y_k) when this cumulative frequency exceeds 3500 be the brightness value (Y_k) of the shadow point.

[0037] In addition, although it asked for cumulative frequency from the brightness location of the brightness value 10 and the brightness value 245 with this operation gestalt, you may have predetermined offset, such as asking from the brightness value 1 and the brightness value 254.

[0038] In S34, as opposed to the brightness histogram for which it asked, the moving average is taken and processing for raising the precision of the judgment which smooths the configuration of a brightness histogram and mentions it later is performed.

[0039] Exposure judging processing of an image and exposure amendment processing according to a judgment result are performed using the brightness histogram for which it asked above.

[0040] First, the peak of the brightness histogram which is needed in the case of the exposure judging processing mentioned later first and exposure amendment processing is detected (S35).

[0041] (Detection of a peak) It explains, referring to the flow chart of the processing which detects the peak of the brightness histogram of drawing 8 about the detection approach (S35) of the peak of a brightness histogram.

[0042] First, by S82, about the brightness histogram for which it asked, threshold Th_f about frequency is prepared and it considers that a brightness value field with the frequency exceeding this threshold is a field where the peak of a brightness histogram exists (A, B, C of drawing 14).

[0043] For example, (all number of pixels which constitutes brightness histogram)/(HL-SD +1) can be used as threshold Th_f here.

[0044] With this operation gestalt, it is attained by continuing shaking the same label as the location where a table corresponds, shifting [prepare the table for label attachment of 256 width (one-dimensional array), when the frequency of a brightness histogram exceeds threshold Th_f and it hits the 1st peak field from a label, for example, low brightness, side, begin to attach a label 1, and] a brightness value to a high brightness side one by one.

[0045]

[(if histogram[j] > Th_f then label_table[j] =1) 0046] That is, for example, if it explains using drawing 14, the label of 1, 2, and 3 will be shaken about each field of the peak fields A, B, and C of drawing 14, respectively, and the digit string of the die length corresponding to the width of each field will be written in the prepared table.

[0047]

[(label_table[j]={0, 0, 0, 1, 1, 1, 1, 1, 0, 0, 0, 2, 2, 0, 0, 0, 3, 3, 3}) 0048] However, Oyama (B of drawing 14) which is hard to be referred to as expressing with the detection approach of a peak field the description of the whole field which is not not much important, i.e., an image, when it is distribution like the brightness histogram shown in drawing 14 will be detected. Then, the cumulative frequency of the field which filled the threshold with this operation gestalt to coincidence in S83 it is [83] passing away of processing which detects the peak of a brightness histogram when comparing with threshold Th_f

about each class mark, i.e., this field, counts the area occupied in an image. And cumulative frequency excepts this field from the field where the peak of a brightness histogram exists about the field below threshold Th_a (drawing 15).

[0049] Since it is a threshold for removing Oyama which is hard to be referred to as expressing the description of the whole image, threshold Th_a is set up according to the description of an image. Th_f twice the value of a threshold is used with this operation gestalt.

[0050] The exclusion approach of a peak uses the equivalence table method with this operation gestalt. Beforehand, the equivalence table (equiv_table[j]=j) which stores 4 in the location corresponding to 4 for the label value 3 is prepared for a certain label, for example, the location corresponding to 3. Next, the value of this table corresponding to the label value which should be excepted on an equivalence table is set to 0. For example, in brightness histogram drawing 14, since it is the label value which B (label 2) should except, it is referred to as equiv_table[2]=0. It can carry out by the label value of the table for label attachment being, and rewriting it with an equivalence table, at the last. For example, it is with a table group, carries out like tmp=label_table[j] label_table[j]=equiv_table[tmp], and the values from 0 to 255 are rewritten.

[0051] Furthermore, in the approach of using threshold Th_a, one may not be found [cumulative frequency / threshold Th_f and / of this brightness value] by the peak of a brightness histogram depending on the configuration of a brightness histogram about a brightness value. In such a case, for example, Th_f=0.5* Th_f can be used instead of Th_f, the detection approach of a peak can be repeated, and the peak of a brightness histogram can surely be found by lowering a threshold one by one.

[0052] The brightness value of the both ends of the called-for peak field is made into the focus Pk (k= 1, 3 [2 and 3], --, max) of a brightness histogram, and the following processings are performed.

[0053] (Exposure judging processing) Exposure judging processing S36 is performed using the brightness value Pk of the both ends about each of two or more peaks searched for by S35.

[0054] Exposure judging processing of this operation gestalt can classify an input image into the exposure S11 of others, such as overexposure S8, the exposure undershirt S10, standard exposure S9, and a backlight.

[0055] It explains with reference to flow chart drawing 4 of the image processing performed in the exposure judging processing section below.

[0056] First, the number of the called-for peak fields is counted (S2). It judges whether the number of peak fields is one (S3).

[0057] - When judged with there being two or more peak fields required in the judgment S3 of the exposure image of others, such as a backlight, an image may be a backlight scene or a portrait image which used the stroboscope of Nighttime. Therefore, when judged with the number of peak fields not being one in S3, it may be the exposure image of others, such as a backlight.

[0058] When the black clothes of a sky where a brightness histogram is bright in the image of standard exposure currently richly expressed in halftone as a whole, or an object are contained, a peak may arise also in the high brightness section or the low brightness section, and two or more peak fields may be generated in the same brightness histogram. It is not desirable to perform exposure amendment like the portrait image which used the stroboscope of a backlight scene image or Nighttime about the image of the standard exposure currently richly expressed in halftone.

[0059] Then, the following judgment processings are performed, the image of standard exposure is detected, and it controls to perform exposure amendment suitable for the image of standard exposure.

[0060] The average I1 of P1 and P2 is calculated by S5. The following processings are performed assuming this average I1 to be the peak value of the peak field defined by P1 and P2.

[0061] With this operation gestalt, it judges whether it is the image of standard exposure using the highlights point (HL) called for by S33, the shadow point (SD), and the average I1 calculated by S5. It is ***** about carrying out the misjudgment law of the image of the standard exposure which has two or more peak fields to it being a backlight image by this judgment.

[0062] Between the shadow point (SD) and the highlights points (HL) specifically has sufficient width of face. for example, the peak field which has the width of face exceeding 160, and is defined by this

operation gestalt P1 and P2 -- the brightness region of ** 0~255 -- it is mostly located at the core -- For example, when the average I1 exceeds 50 and conditions are filled with this operation gestalt a condition [it being less than 150], it judges that this image is "an image of standard exposure" (S9).

[0063] And it judges with it being "the image of other exposures" from which an exposure differs by fields in an image, such as a portrait image using the stroboscope at night which shows luminance distribution like the backlight scene which the image picturized about the image which does not fulfill this condition, without using the stroboscope which shows luminance distribution like the brightness histogram of the backlight image shown in drawing 11, or the brightness histogram shown in drawing 13, (S11).

[0064] - When judged with the number of the peak fields required in the judgment S3 of an exposure undershirt and overexposure being one, an image may be a backlight scene or a portrait image which used the stroboscope of Nighttime.

[0065] Then, the overexposure of an input image judgment and judges [S6] an exposure undershirt by S7 continuously.

[0066] First, by S4, the average I1 is calculated based on P1 and P2, and the average I_{max} is calculated based on P_{max-1} and P_{max}.

[0067] the case where the photographic subject is basking in positive glow soon for example, under the fine weather follow light -- the bright exposure with brightness high, as a whole -- an exaggerated image is obtained. Luminance distribution is the distribution which inclined toward the high brightness side as a whole so that the brightness histogram shown by drawing 10 may also show such a brightness histogram about an image.

[0068] then -- this operation gestalt -- exposure -- the time of relative relation with threshold Th_{over} about the average I1 and a brightness value being $I1 > Th_{over}$ in order to distinguish an exaggerated image in simple -- an input image -- exposure -- it is an exaggerated image -- it is rich and makes (S8). In addition, with this operation gestalt, 190 is used as threshold Th_{over}.

[0069] Next, with this operation gestalt, the exposure undershirt of step S10 is further judged about the input image which was not judged to be overexposure.

[0070] exposure dark as a whole under the situation that the diaphragm amendment by AE (automatic exposure) starts since most backgrounds were blue skies with high brightness as a result of a photographic subject's picturizing, of course using the auto photography function of a camera when it is in the space covered in the shade like [in woods] even if it was under the clouded sky and the fine weather follow light -- an undershirt image is obtained. The brightness histogram about the image in such a case serves as distribution by which the luminance distribution shown with the brightness histogram of the image of the exposure undershirt of drawing 9 or the brightness histogram of the shade image not using the stroboscope of drawing 12 inclined toward the low brightness side as a whole.

[0071] then, the time of relative relation with threshold Th_{under} about a brightness value being $I_{max} < Th_{under}$ about I_{max}, in order to distinguish the image of an exposure undershirt in simple with this operation gestalt -- an input image -- exposure -- it judges with it being an undershirt image (S10). In addition, with this operation gestalt, 60 is used as threshold Th_{under}.

[0072] In addition, an exposure undershirt judging and an overexposure judging may be performed to a reverse order.

[0073] - Judge with the image judged by the image which was not judged by S7 to be an exposure undershirt and S13 to be standard exposure being standard exposure with a standard exposure book operation gestalt (S9).

[0074] (Exposure amendment processing) LUT which was performed by processing shown in drawing 4 and which was alike and suitable for the result of judgment processing of S36 is chosen or created, and exposure amendment according to the exposure of an image is performed using this LUT (S37).

[0075] With this operation gestalt, the input brightness values 0-255 are changed into the output brightness values 0-255 using selected 1-dimensional LUT.

[0076] In addition, with this operation gestalt, about the image judged to be standard exposure, overexposure, and an exposure undershirt, LUT which was suitable for the image about the backlight

scene image each time using fixed LUT (drawing 5 [as opposed to / For example, exposure / an exaggerated image]) is generated automatically, and exposure amendment is performed.

[0077] A picture signal is changed with the procedure of specifically acquiring beforehand creation or the output signal which creates each time and corresponds with reference to LUT by making the pixel value of an input image into an index for the look-up table (LUT) which is the conversion table of an output signal to an input signal as it gets on a gradation curve.

[0078] exposure -- even if an undershirt image looks at a brightness histogram like the display brightness histogram of the exposure undershirt shown in drawing 9, its halftone is too dark so that clearly. Therefore, LUT for exposure undershirts performs exposure amendment to which the gradation of halftone becomes good while making halftone bright.

[0079] moreover, exposure -- the exposure which shows an exaggerated image to drawing 10 -- even if it sees a brightness histogram like the brightness histogram of an exaggerated image, halftone is too bright so that clearly. Therefore, LUT for overexposure performs exposure amendment to which the gradation of halftone becomes good while making halftone dark.

[0080] - As the image of the exposure amendment backlight scene to the exposure image of others, such as a backlight, is shown in the brightness histogram of the drawing 11 backlight image, it is too bright in a high brightness region, and it is too dark in a low brightness region, and it is deficient in the expression of halftone.

[0081] As an image judged to be "other exposures", though a background is a high brightness value, there is a backlight scene image [as / whose person who is the main photographic subject is a low brightness value].

[0082] a backlight scene image -- exposure -- an exaggerated background region and exposure -- although the undershirt main photographic subject field is intermingled, on a backlight scene, exposure amendment processing which makes the main photographic subject field bright is desired.

[0083] So, with this operation gestalt, as shown in drawing 7, LUT is created based on the brightness histogram of an image, and exposure amendment about the image of "other exposures" is performed.

[0084] This LUT is with the average I1 of the minimum brightness point P1 of a peak field of showing the minimum brightness value of the shadow point SD for which it asked, the highlights point HL, and a brightness histogram, the highest brightness point P2 of this field, and this field, and is expressed with the following formulas.

[0085] In addition, let x into an input brightness value and let y be an output brightness value. Moreover, the average I1 is used here as what is replaced with the true value of the peak of a brightness histogram based on the assumption that it is located at the core of the peak field for which the peak of a brightness histogram asked. Here, when it is not located at the core of the peak field for which the true peak of a brightness histogram asked but inclines sharply at the end of the peak field, a more suitable result can be obtained by giving the brightness value of these peak field both ends and a core manually.

[0086] $y = 0 \quad (0 \leq x < SD) \quad y = 0 = (P1 - 0) / (P1 - SD) * (x - SD)$ where $y - P(SD \leq x \leq P1) = A * (I' - P1) / (I1 - P1) * (x - P1)$ $y - y(P1 \leq x \leq P2) = (255 - y(P2)) / (HL - P2) * (x - P2)$ $y(P2 \leq x \leq HL) = 0 \quad [(HL < x)]$ [0087] It is possible to ask for the gradation curve which amends a brightness value preponderantly about the field which has the brightness of P1 to P2 by constituting LUT as mentioned above and calculating sequentially from a low brightness side about x.

[0088] I' uses the value calculated by the following formulas here.

[0089] $I' = 1.5 * (I1 - SD)$ [0090] Moreover, the term which emphasizes the inclination which becomes $A = 1.2$ in order to shift this whole brightness histogram to a high brightness region, when the brightness histogram of an image which is $HL < 170$ inclines toward the low brightness side greatly for example, can also be applied to the above-mentioned formula.

[0091] Furthermore, although the slope of a line is decided by the above-mentioned formula in the section of $(P1 \leq x \leq P2)$, the difference will be set to 10 after conversion by the pixels it was a brightness value with the difference near 1 before [whose] conversion as this inclination is too much steep, and a smooth gradation change will be lost. So, with this operation gestalt, it is decided by $x = P1$. $(P1 \leq x \leq P2)$ The inclination of the gradation curve of the section is restricted to 2.0 from 0.6. In

addition, when y (P_2) calculated using the inclination for which it asked exceeds 220 so that the section of ($P_2 \leq x \leq HL$) may become short too much and the smooth gradation expression by the side of high brightness may not be lost with the value of an inclination, he adjusts an inclination and is trying to set y (P_2) to 220.

[0092] According to the 1st operation gestalt, it can judge in [exposure / of an image] simple.

[0093] Furthermore, according to an exposure, optimal exposure amendment can be performed automatically.

[0094] [2nd operation gestalt] The 2nd operation gestalt of this invention is explained.

[0095] Since the system (drawing 1) used with the 2nd operation gestalt and the rough flow (drawing 3) of an image processing are the same as that of the 1st operation gestalt, they omit explanation, and they describe only difference.

[0096] (Detection of a peak) In case the peak of a brightness histogram is detected, although, only for the field which has the frequency more than threshold Th_f with the 1st operation gestalt of this invention furthermore -- the time of there being the need of investigating distribution of a detailed peak -- the brightness of 0-255 -- range -- for example, it divides into 16 equally, the height of each field is compared, and approaches, such as considering that a field with bigger frequency than neighboring fields is a peak field, can be considered.

[0097] Moreover, since all the fields of the brightness histogram in the brightness value section divided by this brightness value group will have the same number of pixels when it asks for a brightness value group from which the class mark of an accumulation brightness histogram serves as exponentiation division into equal parts of 2 about an accumulation brightness histogram, the more the section is short, the more the frequency in this section will be high. Therefore, it is also possible to detect the peak of a brightness histogram by comparing the die length of the section.

[0098] (Exposure judging), without preparing both an overexposure judging module and an exposure undershirt judging module, when performing an exposure judging Prepare only an overexposure module, set what carried out bit flipping of the threshold for an exposure undershirt judging, and as an input image to a module by for example, the thing for which what carried out bit flipping of the subject-copy image for every pixel is used One module can also be used for detection of both overexposure and an exposure undershirt, and when carrying out especially using hardware, a resource can be utilized effectively.

[0099] Moreover, since threshold Th_{under} shows the degree of the exposure undershirt of an image to some extent, it can adjust further the image of the darkness to how much, i.e., is the image of the degree of the exposure undershirt to how much judged as an exposure undershirt?, by changing a threshold suitably. For example, you may enable it to adjust based on manual directions of a user.

[0100] Moreover, in case it judges whether it is the image of an exposure undershirt, it is possible to use together the cumulative frequency about the peak field which has this peak other than a peak location, i.e., the number of pixels which constitutes the peak located in the minimum brightness side occupied in [all] an image, and to express the degree of an exposure undershirt. It is also possible to use the width of face of a peak for the same purpose. Moreover, it is possible to express the degree of overexposure like the case of an exposure undershirt judging using the cumulative frequency about the peak field which has threshold Th_{over} , the peak location located in the highest brightness value, and this peak location, the width of face of a peak, etc. And you may process choosing what corresponds among two or more LUTs for exposure undershirt amendment according to the degree of the exposure undershirt for which it asked, and overexposure etc.

[0101] (Exposure amendment) Although image amendment is performed with the 1st operation gestalt, without taking the gamma characteristics of input/output equipment into consideration, when gamma characteristics are known, it is desirable to perform exposure amendment of this invention, after taking gamma characteristics into consideration.

[0102] In addition, when the highlights point and the shadow point are known, the known value which corresponds as the highlights point and the shadow point may be used.

[0103] Moreover, it is also possible to be with a digital camera or a scanner, and for the image pick-up

mode at the time of incorporating about the captured image to be interlocked with, and to change for example, the threshold for a judgment at the time of the excess of exposure and the judgment of an undershirt.

[0104] Moreover, it is also possible to divide a subject-copy image in a suitable field, and to perform this exposure judging or this exposure amendment processing separately about the each.

[0105] Moreover, processing which weakens a picture signal about blue in order to make it not judged with overexposure by image which occupies many whose blue sky is the configuration pixel in case a brightness histogram is created may be performed.

[0106] Moreover, at least one or the load sum about the picture signal of R, G, and B can be used as an input signal of judgment processing among the picture signals of R, G, and B at the time of the excess of exposure, and the judgment of an undershirt.

[0107] Moreover, although the average of the detected peak field was used as a peak location of a brightness histogram with the 1st operation gestalt, a mean value, the suitable load sum, etc. can also be used.

[0108] Moreover, although the gradation curve of two break points was used with the 1st operation gestalt like LUT shown in drawing 7 as a gradation curve, it is possible to mitigate computational complexity by using the gradation curve of one break point still like LUT of drawing 6 in simple. Or when a smooth change of halftone is required, it is possible to be with approximation curves, such as a SHUPU line curve, and to connect a gradation curve smoothly.

[0109] Moreover, with the 1st operation gestalt, although LUT of immobilization was used in the exposure amendment to standard exposure, an exposure undershirt, and the image of overexposure, it may be made to perform exposure amendment using LUT created based on HL and SD which were calculated by S33. For example, LUT can be created by setting up a curve from which SD is changed into the brightness value 10 and it changes HL into the brightness value 245 in consideration of SD and HL.

[0110] Moreover, although it has only the mode in which an exposure is automatically judged based on a histogram, with the 1st operation gestalt, you may have the mode in which an exposure is judged based on manual directions of a user.

[0111] (Other operation gestalten) The storage which stored the means for supplying the program code for realizing an operation gestalt function to the equipment or the system connected with these various devices so that the function of the operation gestalt mentioned above might be realized and this invention might operate various kinds of devices itself, and its program code to a computer, for example, this program code, constitutes this invention.

[0112] As a storage which stores this program code, a floppy disk, a hard disk, an optical disk, a magneto-optic disk, CD-ROM, a magnetic tape, the memory card of a non-volatile, ROM, etc. can be used.

[0113] Moreover, by performing the program code with which the computer was supplied, also when the function of the above-mentioned operation gestalt is not only realized, but the function of the above-mentioned operation gestalt is realized in collaboration with OS (operating system) to which the program code is working in a computer, or other application software, it cannot be overemphasized that this program code is contained in the operation gestalt of this invention.

[0114] Also when the function of the operation gestalt which performed a part or all of processing that CPU with which directions of the program code are based and the functional add-in board and a functional storing unit are equipped is actual, and mentioned above by the processing is realized after the program code furthermore supplied is stored in the memory with which the functional expansion unit connected to the functional add-in board and the computer of a computer is equipped, it is needless to say in being contained in this invention.

[0115] Moreover, two or more above-mentioned operation gestalten may be combined.

[0116]

[Effect of the Invention] This invention can perform a suitable image processing according to an exposure.

[0117] Invention of this application claim 1 can perform the image processing which judged and carried out backlight scene ** of the image of a backlight scene.

[0118] Invention of this application claim 8 can judge the image with which the **** image pick-up of the night was carried out for stroboscopes, and can perform the image processing which carried out backlight scene **.

[Translation done.]

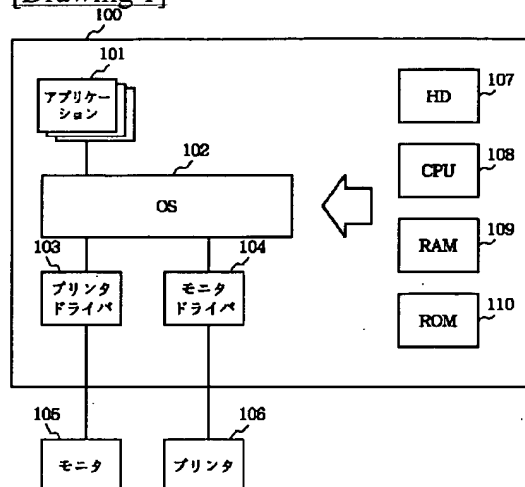
* NOTICES *

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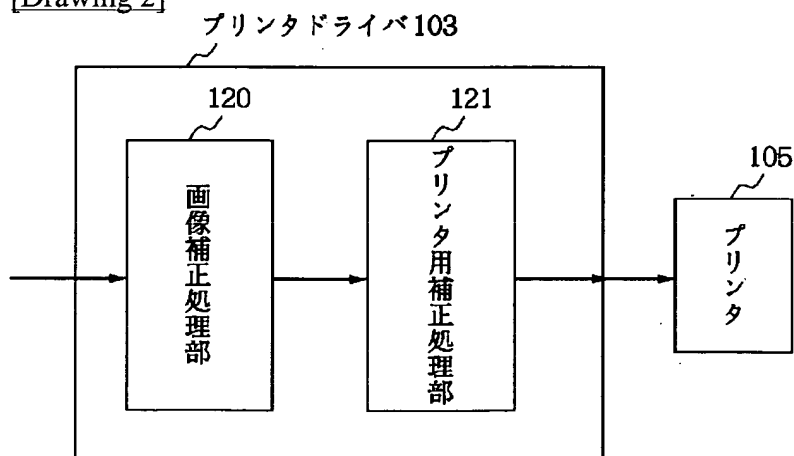
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

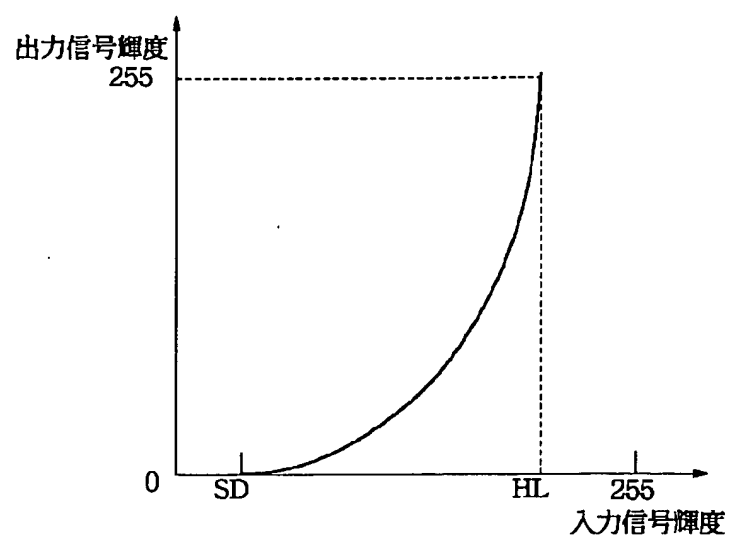
[Drawing 1]



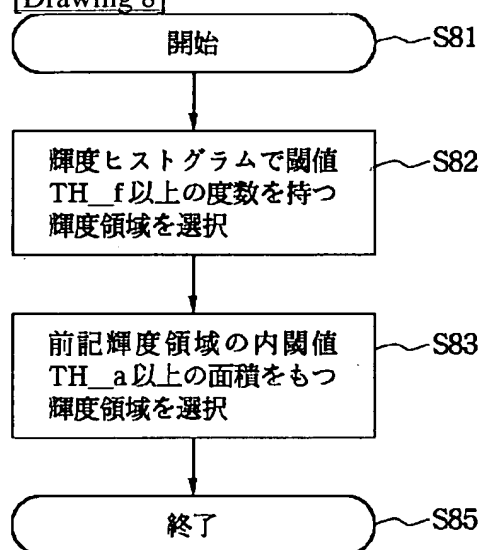
[Drawing 2]



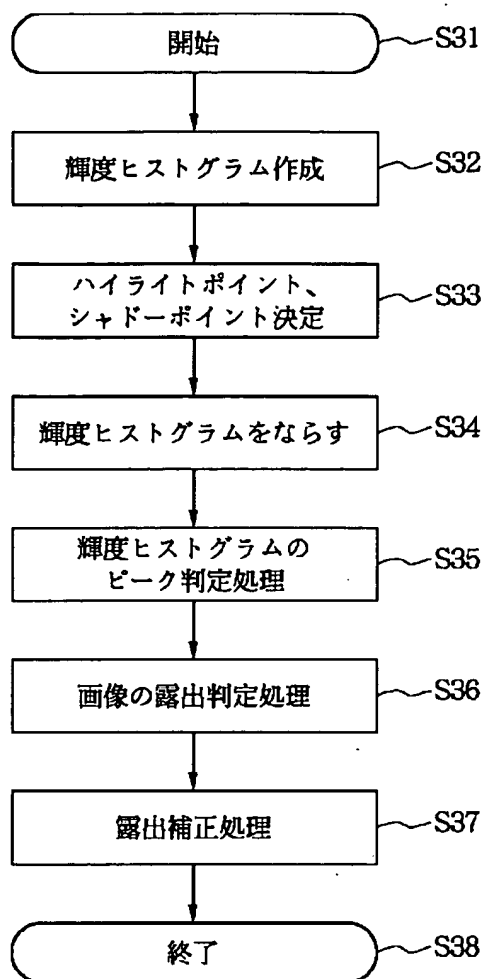
[Drawing 5]



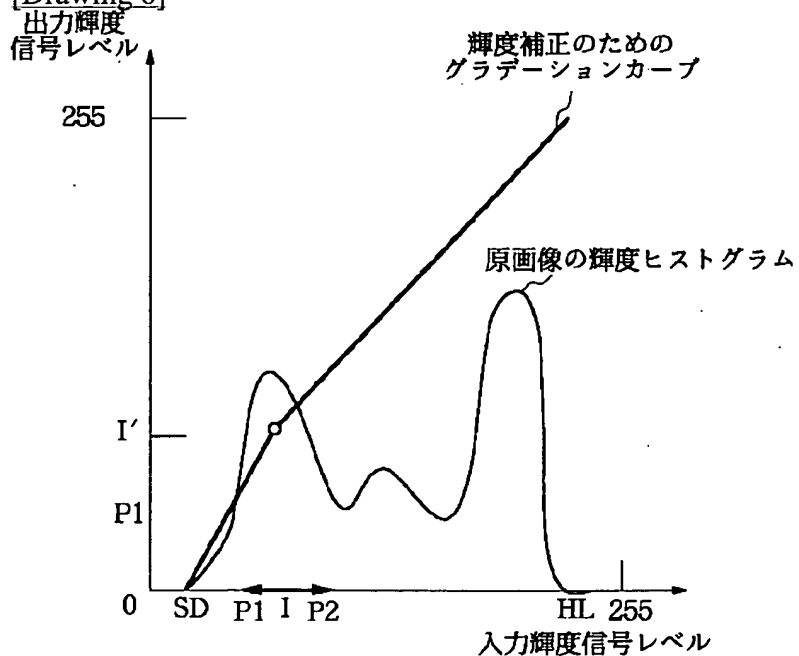
[Drawing 8]



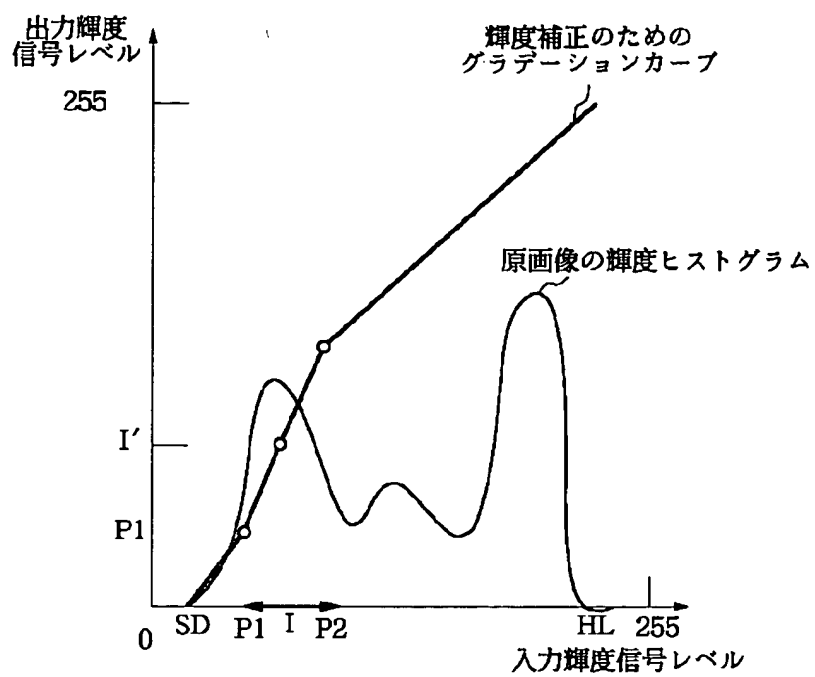
[Drawing 3]



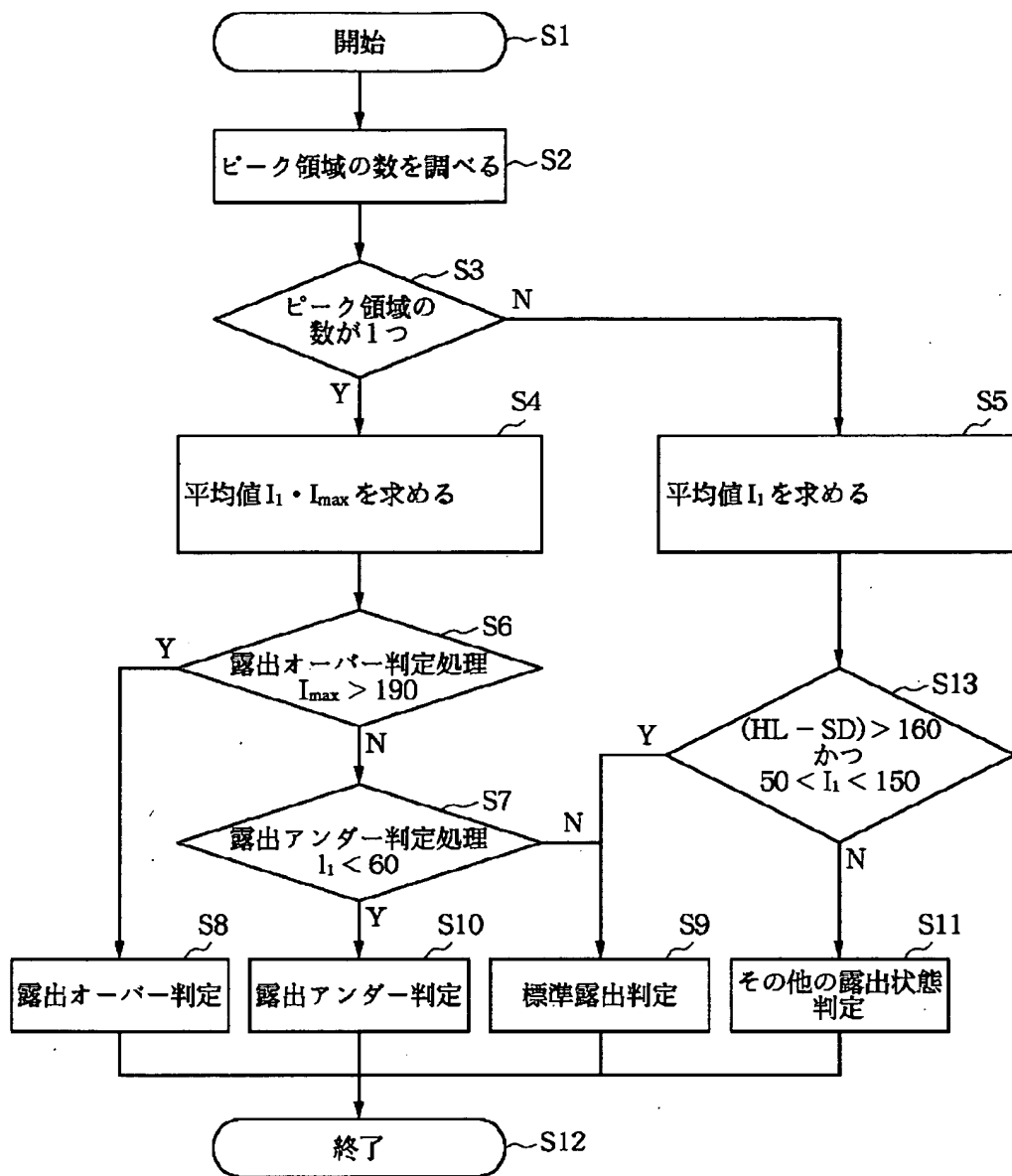
[Drawing 6]



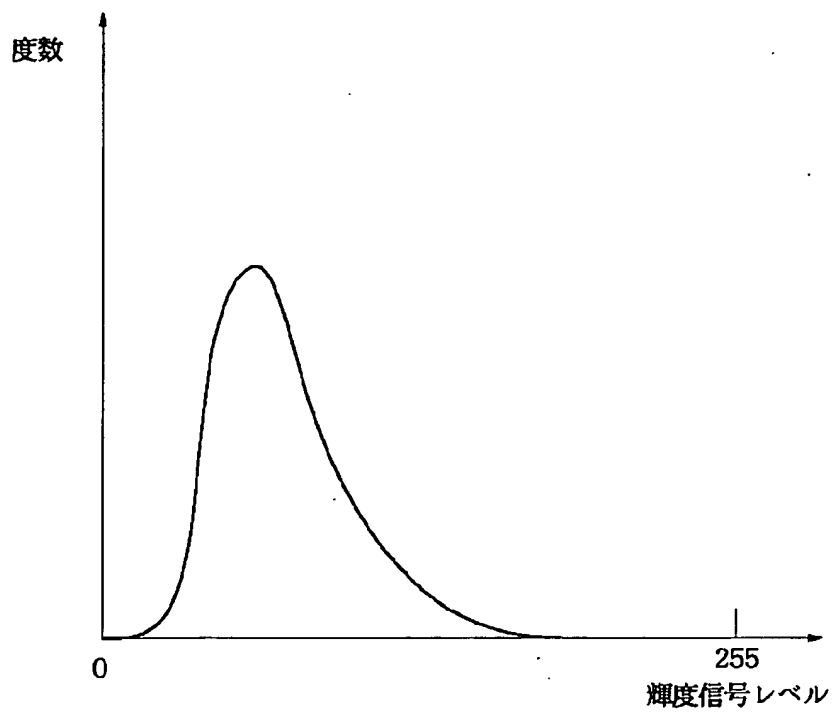
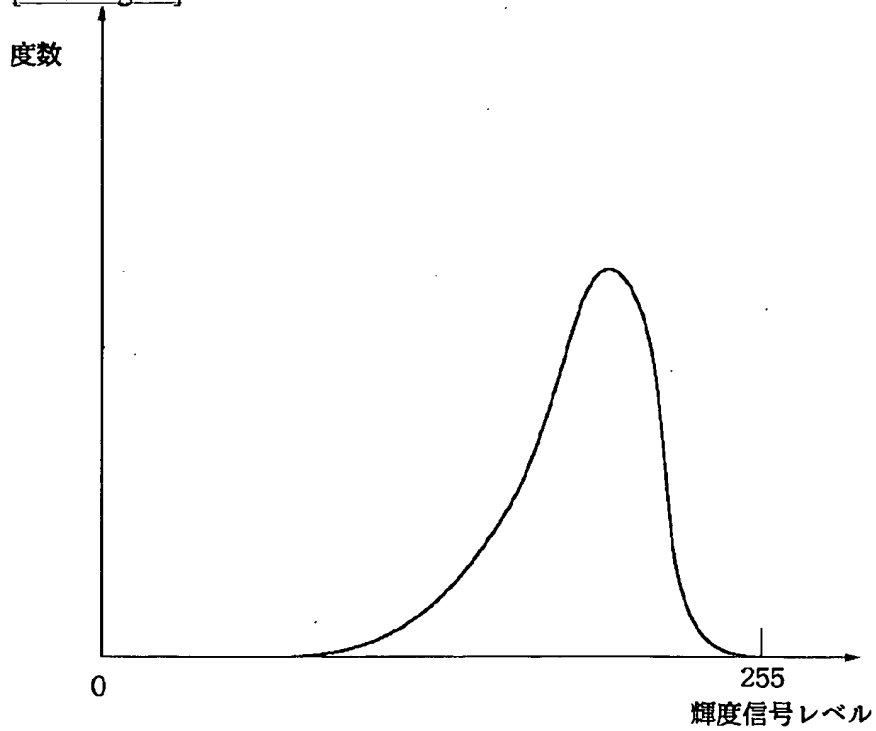
[Drawing 7]

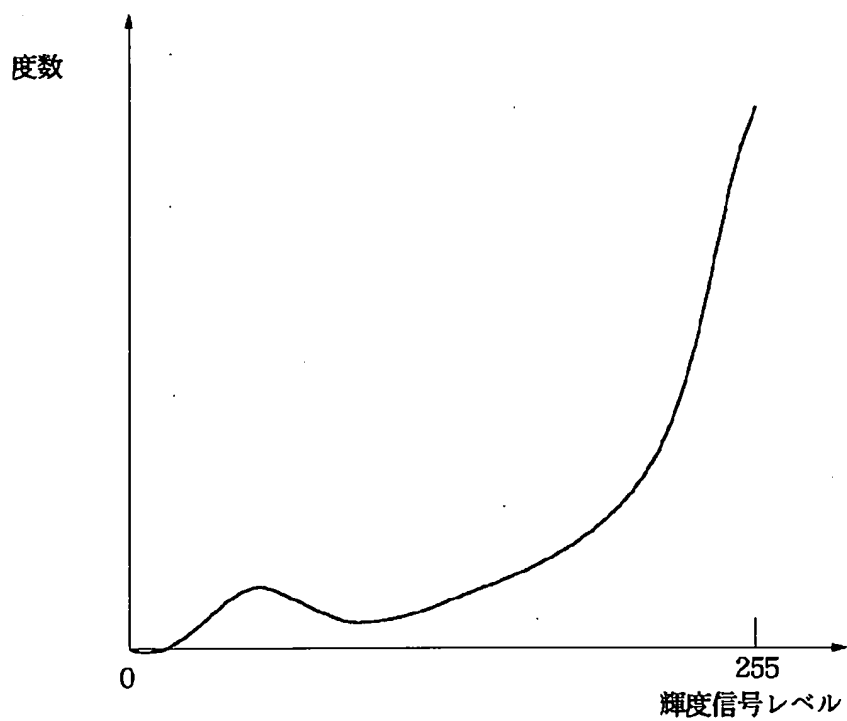
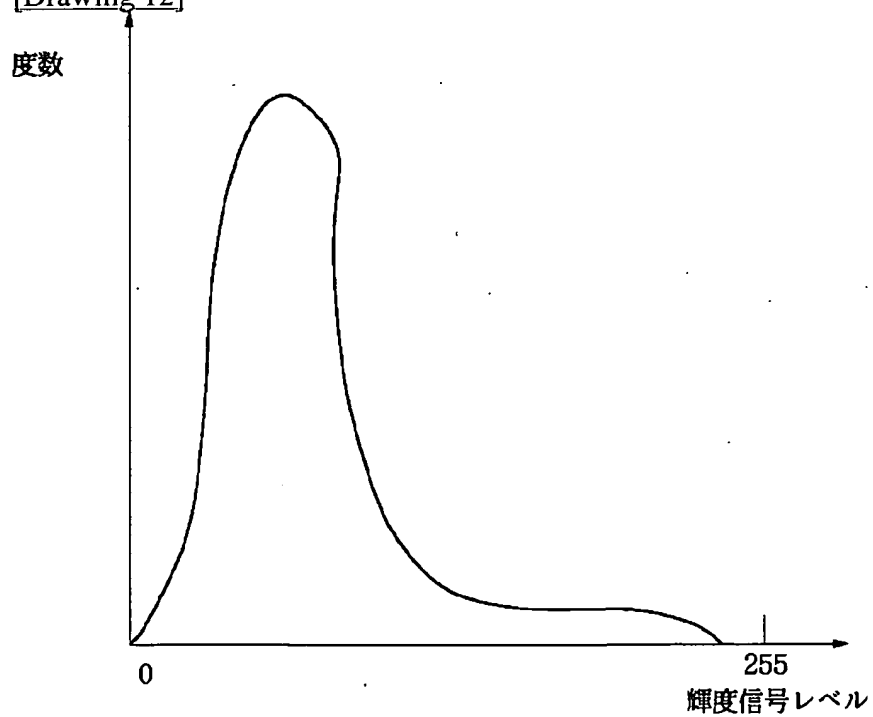


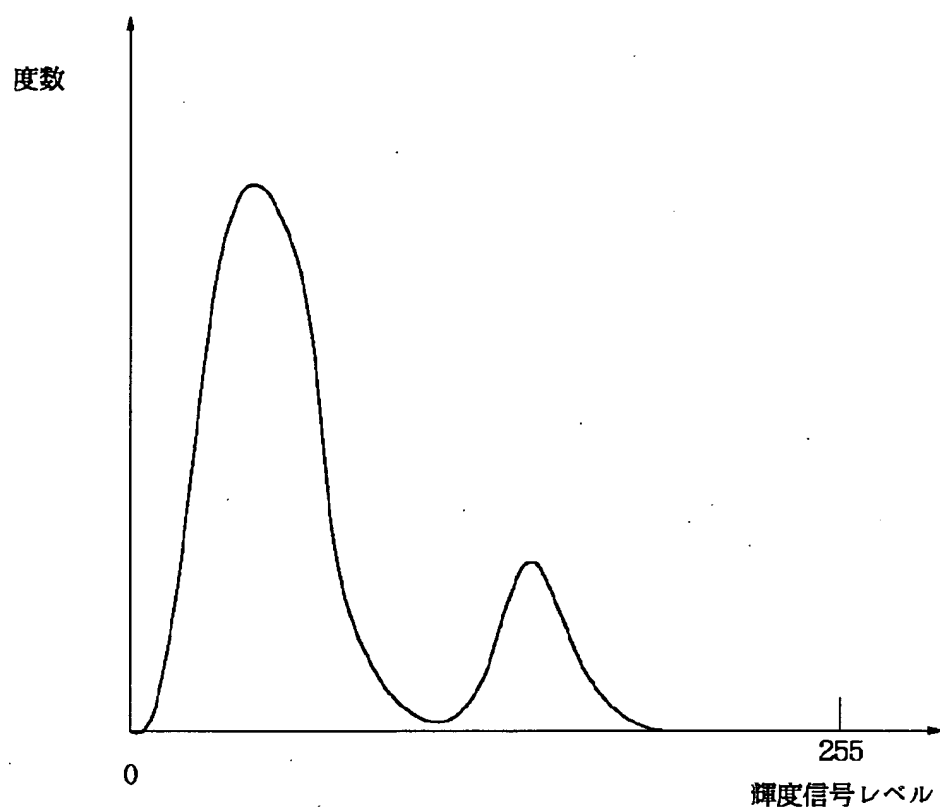
[Drawing 4]



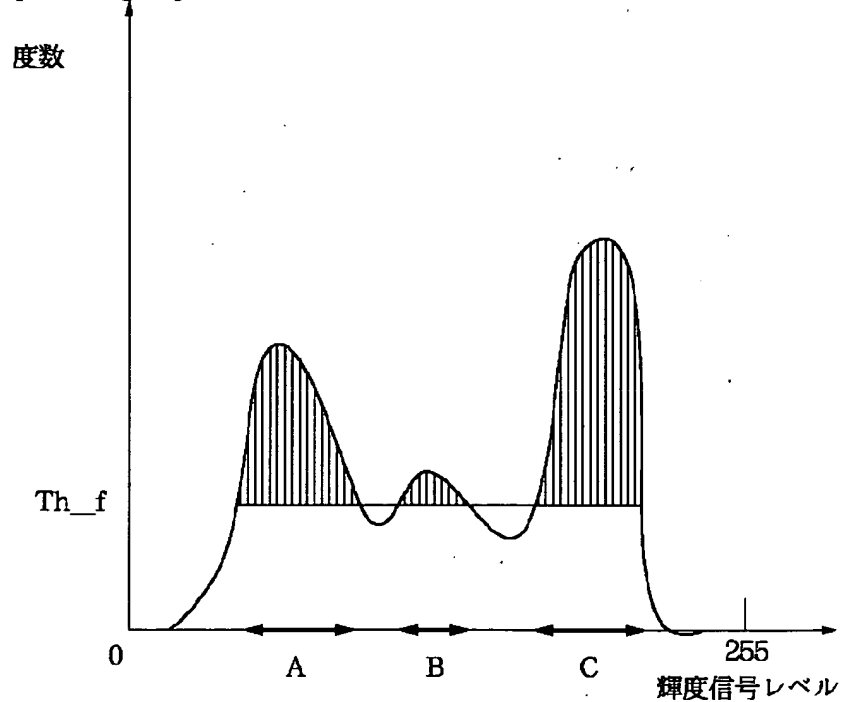
[Drawing 9]

[Drawing 10][Drawing 11]

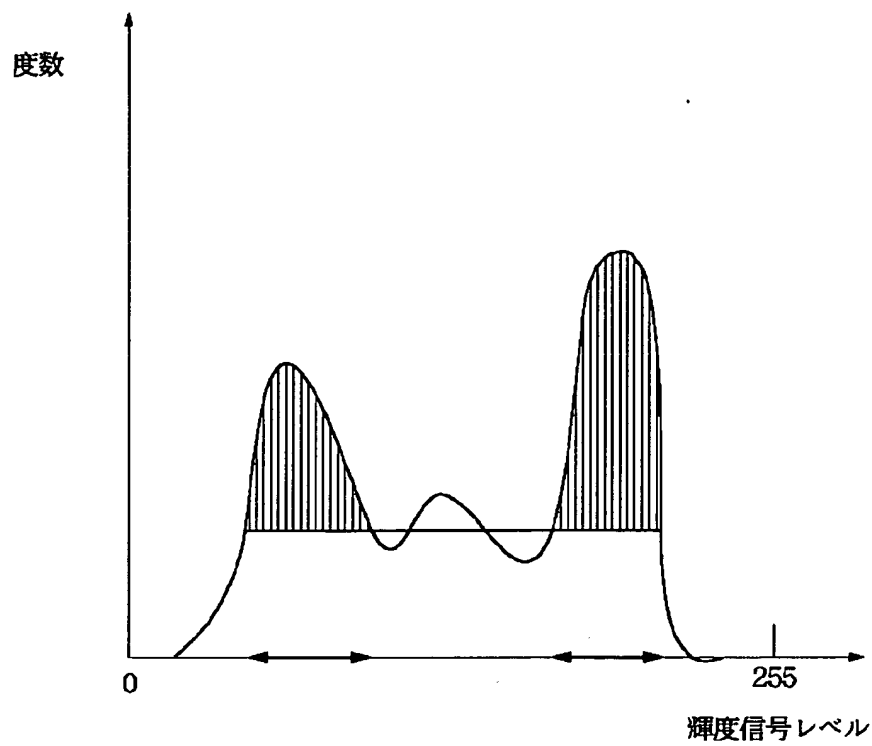
[Drawing 12][Drawing 13]



[Drawing 14]



[Drawing 15]



[Translation done.]